Assessment of side-effects of pesticides on non-target organisms (other than bees) and its transfer into practice

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Assessment of the effects of plant protection products on non-target arthropods

- Evaluation of the effects:
  labelling of plant protection products as not/slightly/harmful to non-target arthropods

- Experience in the evaluation/labelling of Biorationals
Where can I find the labelling of the effects?

Federal Office of Consumer Protection and Food Safety (BVL)
- Registration report of plant protection products
- data sheet ppp
- Register of plant protection products:

NN2001 The product is classified as slightly harmful for populations of relevant beneficial insects.

NN2002 The product is classified as is slightly harmful for populations of relevant beneficial predatory mites and spiders.
Why are the effects of ppp assessed and labelled?

Directive 2009/128/EC

General principles of integrated pest management:

(1) “The prevention and/or suppression of harmful organisms should be achieved or supported among other options especially by: protection and enhancement of important beneficial organisms, e.g. by adequate plant protection measures or the utilisation of ecological infrastructures inside and outside production sites."

(5) „The pesticides applied shall be as specific as possible for the target and shall have the least side effects on human health, non-target organisms and the environment. “

Plant Protection Act

- The general principles of "Integrated Pest Management" and those of "Good Technical Practice" must be observed.

- No unacceptable effects on the ecosystem through the use of pesticides.
How do we get the data?

context of the authorisation procedures for ppp's
Which test guidelines have to be observed?

Joint Initiative (1994): developed and validated test methods

- IOBC (International Organisation for Biological Control),
- BART (Beneficial Arthropod Regulatory Testing Group),
- EPPO (European and Mediterranean Plant Protection Organization)

Candolfi et al. (2000): Guidelines to evaluate side-effects of plant protection products to non-target arthropods

- test system
- treatments
- validity criteria of the study
- information on testorganism
- test procedure, conditions
- biological observations
- data analysis, reporting
Which species are tested? For which species are there test guidelines?

populations of relevant beneficial predatory mites and spiders

Typhlodromus pyri

populations of relevant beneficial insects

Aphidius rhopalosiphi
populations of relevant beneficial predatory mites and spiders

*Typhlodromus pyri* (predatory mite, sensitive standard species)

Spiders of genus *Pardosa* (lycosid spiders)

populations of relevant beneficial insects

*Aphidius rhopalosiphi* (parasitic wasp, sensitive standard species)

*Chrysoperla carnea* (lacewing)

*Poecilus cupreus* (carabid beetle)

*Aleochara bilineata* (rove beetle, staphylinid beetle)

*Coccinella septempunctata* (ladybird, plant dwelling insect)

*Orius laevigatus* (predatory bug)

*Trichogramma cacoeciae* (chalcid wasp)
Which effects are tested?

<table>
<thead>
<tr>
<th>Lethal effects</th>
<th>Sublethal effects</th>
</tr>
</thead>
<tbody>
<tr>
<td>Corrected Mortality [%]</td>
<td>Food consumption [%]</td>
</tr>
<tr>
<td></td>
<td>Reproduction [%]</td>
</tr>
</tbody>
</table>
Classification of the effects

<table>
<thead>
<tr>
<th>Laboratory test</th>
<th>Extended laboratory test</th>
<th>Semi-field conditions</th>
<th>Field conditions</th>
</tr>
</thead>
</table>

**Artificial exposure conditions**

- **Lethal/sublethal effects:**
  - <30% = Not harmful
  - 30 – 80% = Slightly harmful
  - >80% = Harmful

**Naturally:**

- <25% = Not harmful
- 25 – 50% = Slightly harmful
- >50% = Harmful
How are the effects derived from the data?

Example: ppp “Moritz”

Application: ornamentals, greenhouse
rate : 2L product (60 g/L orange oil) = 120 g a.s./ha orange oil

Table 1: Effects of AB34 (58 g/L orange oil) on beneficial arthropods in laboratory tests on artificial substrates

<table>
<thead>
<tr>
<th>Species</th>
<th>Substrate</th>
<th>Rate orange oil [g a.s./ha]</th>
<th>Corrected Mortality [%]</th>
<th>Sublethal Effect Reproduction [%]</th>
<th>Reference</th>
</tr>
</thead>
<tbody>
<tr>
<td><em>Typhlodromus pyri</em></td>
<td>glass</td>
<td>43</td>
<td>38.4</td>
<td>10.9</td>
<td>211520</td>
</tr>
<tr>
<td></td>
<td></td>
<td>120</td>
<td>45.4</td>
<td>28.1</td>
<td>(Müller, 2011)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>250</td>
<td>50.6</td>
<td>53.1</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>600</td>
<td>95.0</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

<30% = not harmful
30 – 80% = slightly harmful
>80% = harmful

**JKI: NN 234 = Moritz** is slightly harmful for populations of *Typhlodromus pyri* (predatory mite).

**BVL: NN2002 = Moritz** is slightly harmful for populations of relevant beneficial predatory mites & spiders.
Example: ppp “Moritz”

Application: ornamentals, greenhouse
rate       : 2L product (60 g/L orange oil) = 120 g a.s./ha orange oil

Table 1: Effects of AB34 (56 g/L orange oil) on beneficial arthropods in laboratory tests on artificial substrates

<table>
<thead>
<tr>
<th>Species Substrate</th>
<th>Rate orange oil [g a.s./ha]</th>
<th>Corrected Mortality</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>&lt;30% = not harmful</td>
</tr>
<tr>
<td></td>
<td></td>
<td>30 – 80% = slightly harmful</td>
</tr>
<tr>
<td></td>
<td></td>
<td>&gt;80% = harmful</td>
</tr>
<tr>
<td>Aphidius rhopalosiphi</td>
<td>glass</td>
<td>21</td>
</tr>
<tr>
<td></td>
<td>38</td>
<td>0</td>
</tr>
<tr>
<td></td>
<td>68</td>
<td>6</td>
</tr>
<tr>
<td></td>
<td>120</td>
<td>9.6</td>
</tr>
</tbody>
</table>

JKI: NN2842 = Moritz is slightly harmful for populations of Aphidius rhopalosiphi (braconid wasp).

BVL: NN2001 = Moritz is slightly harmful for populations of relevant beneficial insects.
Providing information, informing users

Federal Office of Consumer Protection and Food Safety

- Registration report of plant protection products
- data sheet ppp
- Register of plant protection products:

NN2001 The product is classified as slightly harmful for populations of relevant beneficial insects.

NN2002 The product is classified as is slightly harmful for populations of relevant beneficial predatory mites and spiders.
Providing information, informing users

online Database
species-specific labelling

Suche nach Zulassungsnummer:
004329

Suche nach Mittelname:
Moritz
Providing information, informing users

online Database species-specific labelling

Signs for the effects:

- not harmful
- slightly harmful
- harmful
- insufficient data
Assessment of the effects of plant protection products on non-target arthropods

- Evaluation of the effects:
  
  labelling of plant protection products as not/slightly/harmful to non-target arthropods

- Experience in the evaluation/labelling of Biorationals
Assessment/Labelling of Biorationals

What kind of active ingredients are we talking about?

**Microorganisms**
- *Bacillus thuringiensis* subspecies kursaki Stamm ABTS-351 (Stamm HD-1)
- *Bacillus amyloliquefaciens* Stamm QST 713
- Pepino Mosaic Virus Stamm CH2 (Isolat 1906)
- Ampelomyces quisqualis Stamm AQ 10
- Coniothyrium mimitans Stamm CON/M/91-08
- Pythium oligandrum M1 (Oomycete)

...  

**Plant extracts**
- Azadirachtin
- Pyrethrine
- Vegetable oils (rapeseed, peppermint, orange...)
- Maltodextrin

...  

**Semiochemicals**
- (Z)-9-Dodecen-1-ylacetat

...
Assessment/Labelling of Biorationals

Examples from the online database

Classification scheme:
- green: not harmful
- yellow: slightly harmful
- red: harmful
- orange: insufficient data

- Results of studies show effects <25% or 30%
- because of the selectivity of the product population of relevant beneficial organism are not affected
- due to the application specified with the registration population of relevant beneficial organism are not affected (trunk injection, single plant treatment wiping, application in storage)
Assessment/Labelling of Biorationals

Examples from the online database

The product is classified as ‘not harmful to relevant:

- beneficial insects
- predatory mites and spiders’

<table>
<thead>
<tr>
<th>Product</th>
<th>Active substance</th>
<th>[ ]</th>
<th>[ ]</th>
</tr>
</thead>
<tbody>
<tr>
<td>XenTari</td>
<td>Bacillus thuringiensis subspecies aizawai ABTS-1857</td>
<td>[ ]</td>
<td>[ ]</td>
</tr>
<tr>
<td>CARPOVIRUSINE</td>
<td>Cydia pomonella Granulovirus mexikanisches Isolat</td>
<td>[ ]</td>
<td>[ ]</td>
</tr>
<tr>
<td>Contans WG</td>
<td>Coniothyrium mimitans CON/M/91-08</td>
<td>[ ]</td>
<td>[ ]</td>
</tr>
<tr>
<td>BIOX-M</td>
<td>Spearmint oil</td>
<td>[ ]</td>
<td>[ ]</td>
</tr>
</tbody>
</table>
Assessment/Labelling of Biorationals

Examples from the online database

The product is classified as ‘not harmful to populations of the species’….

<table>
<thead>
<tr>
<th>Species</th>
<th>CARPOVIRUSINE EVO 2</th>
<th>Dipel ES</th>
</tr>
</thead>
<tbody>
<tr>
<td>Typhlodromus pyri (predatory mite)</td>
<td>Cydia pomonella Granulov. Isol. GV-R5</td>
<td>Bacillus thuringiensis subsp. kurstaki St. ABTS-351</td>
</tr>
<tr>
<td>Aphidius rhopalosiphi (braconid wasp)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Poecilus cupreus (ground beetle)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Chrysoperla carnea (lacewing)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Coccinella septempunctata (ladybird)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Aleochara bilineata (staphylinid beetle)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Pterostichus melanarius (ground beetle)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Trichogramma cacoeciae (chalcid wasp)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Phygadeuon trichops (ichneumonid wasp)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Coccygomimus turionellae (ichneumonid wasp)</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
Assessment/Labelling of Biorationals

Examples from the online database

The product is classified as to populations of the species:

- not harmful
- slightly harmful
- harmful
- insufficient data

<table>
<thead>
<tr>
<th>Species</th>
<th>NeemAzal-T/S</th>
<th>Neem Plus Schädlingsfrei</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Azadirachtin</td>
<td>Azadirachtin + Rapsöl</td>
</tr>
<tr>
<td><strong>Typhlodromus pyri</strong> (predatory mite)</td>
<td>NN234</td>
<td>NN334</td>
</tr>
<tr>
<td><strong>Aphidius rhopalosiphi</strong> (braconid wasp)</td>
<td>NN1842</td>
<td>NN1842</td>
</tr>
<tr>
<td><strong>Poecilus cupreus</strong> (ground beetle)</td>
<td></td>
<td>NN165</td>
</tr>
<tr>
<td><strong>Chrysoperla carnea</strong> (lacewing)</td>
<td>NN370</td>
<td></td>
</tr>
<tr>
<td><strong>Episyrphus balteatus</strong> (hover fly)</td>
<td>NN391</td>
<td></td>
</tr>
</tbody>
</table>

BVL - group label:
Assessment/Labelling of Biorationals

Examples from the online database

The product is classified as ‘insufficient data’ for the groups of
- relevant beneficial insects
- relevant beneficial predatory mites and spiders

<table>
<thead>
<tr>
<th>Product(s)</th>
<th>Active Substance</th>
</tr>
</thead>
<tbody>
<tr>
<td>Blossom Protect;</td>
<td>Aureobasidium pullulans DSM 14940 +</td>
</tr>
<tr>
<td>Botector</td>
<td>Aureobasidium pullulans DSM 14941</td>
</tr>
<tr>
<td>Integral Pro</td>
<td>Bacillus amyloliquefaciens MBI 600</td>
</tr>
<tr>
<td>Gnatrol SC</td>
<td>Bacillus thuringiensis subsp. israelensis (Serotyp H-14) AM65-52</td>
</tr>
<tr>
<td>Prestop</td>
<td>Clonostachys rosea J1446</td>
</tr>
<tr>
<td>EPSOM</td>
<td>Fish oil</td>
</tr>
<tr>
<td>Vintec</td>
<td>Trichoderma atroviride SC1</td>
</tr>
<tr>
<td>Eradicoat</td>
<td>Maltodextrin</td>
</tr>
</tbody>
</table>

→ Missing data, no studies on the effects on beneficials available
Assessment/Labelling of Biorationals

Challenges

A) No studies on the effects of the test product are submitted with reference to:
   - the “natural occurrence of the substance in nature”
     (but: … the dose makes the poison)
   - the selectivity of the substance

B) Only studies on the effect of the active substance or other PPP with the same active substance are submitted
   but: PPP’s are evaluated and not their active ingredients (disregarding formulation effect)

C) Test guidelines are very specific regarding the application method (spraying, seed treatment, water soluble substances)

D) For some species no guidelines for higher tier testing are available

E) Often no degradation rates of the product are available (e.g. products with microorganism) for the calculation of exposition
Summary

- the assessment/labelling of the effects of ppp’s on beneficial arthropods is regulated
- there are standardized methods
- existing methods are mainly available for spray applications, methods for further application techniques would be desirable
- studies are submitted as part of the authorization process, which are evaluated and from which effects are derived
- effects are published as a group-specific summary on the data sheet and in the register of ppp’s
- in future, simplified access to the information is to be guaranteed by making the data available online - species-specifically, different application rates
- labelling can be used to select ppp’s with lower effects on beneficial arthropods
Assessment of the effects of pesticides (ppp) on non-target arthropods (other than bees) and its transfer into practice

Marlen Heinz & Peggy Marx

Thank you for your attention.